Acute Cholecystitis Complicating Trauma

ROBERT W. DuPRIEST, JR., M.D.,* SATISH C. KHANEJA, M.D.,† R ADAMS COWLEY, M.D.‡

Twelve patients developed acute cholecystitis complicating trauma. Acute acalculus cholecystitis was present in 11 patients. Nine patients died. A review of 20 reports comprising 98 patients shows 86.7% had acute acalculus cholelithiasis, and 61.1% had necrosis, gangrene, and/or perforation of the gallbladder. The overall mortality was 33.3% and only 16.1% of patients treated by cholecystectomy died. The etiology of acute cholecystitis complicating trauma is multifactorial. Gallstones are present infrequently whereas shock, increased bile pigment load, drugs, surgery, and (other) trauma are common precursors. Diagnosis is difficult and depends upon clinical suspicion and the physical examination. Immediate surgical intervention is required. Cholecystectomy is the procedure of choice. We recommend cholecystectomy at initial laparotomy whenever there is evidence of trauma to the gallbladder, or if the right or common hepatic artery is ligated for hepatic bleeding.

From the Maryland Institute for Emergency Medical Services, University of Maryland Medical School Hospital, Baltimore, Maryland

IN 1906 KOCHER AND MATTI[26] observed acute cholecystitis following gastroduodenostomy. Forty-one years later the clinical entity of "acute cholecystitis following the surgical treatment of unrelated disease" was defined by Glenn[12] and confirmed by numerous other reports.[2,9,13,23,25,27,29,34,41,42,46,47,51,52,56,57] Acute cholecystitis may also complicate burns[38] and trauma.[4,16,20,22,24,28–30,34,36,39,42,46,49,50,58,60] Diagnostic difficulty and advanced local pathology contribute to marked morbidity and mortality. We report on 12 patients, review the pertinent available literature, and discuss the etiology, diagnosis and management of acute cholecystitis complicating trauma.

Methods and Materials

The records of all patients having acute cholecystitis at the Maryland Institute for Emergency Medical Services[5] from September 1972 to December 1977 were reviewed. Only patients with true gallbladder inflammation were included. All patients were trauma victims with severe multiple injuries and complications (Table 1). Patients with direct gallbladder injury were excluded.

Results

Current Series—12 Patients

Table 2 summarizes data on 12 patients with acute cholecystitis complicating trauma. Age ranged from 18 to 67 years, averaging 45.1 years. Acute cholecystitis occurred on the third to 36th postinjury day (mean 14.3 days). The correct diagnosis was suspected preoperatively in two patients. Diagnosis was made at laparotomy in eight patients and at autopsy in two. Acute acalculus cholecystitis was present in 11 patients. Only one had stones. Necrosis, gangrene, or perforation was present in seven patients (58.3%). There were no characteristic biochemical abnormalities. The serum bilirubin ranged from 2 to 7 mg% at the time of laparotomy for acute cholecystitis. Nine patients died, a mortality of 75%.

20 Combined Series—98 Patients

Table 3 summarizes the data from our series and 19 other reports on acute cholecystitis in 98 trauma patients. Eighty-five patients (86.7%) had acute acalculus cholecystitis. Thirteen (13.3%) had acute cholecystitis with cholelithiasis. Ten of 90 patients (11.1%) had gallbladder perforation and 47 (52.2%) had gangrene or necrosis. Thus, 55 (61.1%) (see footnote f in Table 3) had one or more of these advanced pathologic features. Of 90 patients, 60 (66.7%) underwent cholecystectomy and 15 (16.7%) cholecystostomy. Fifteen were not treated surgically for cholecystitis. Twenty-eight of 84 patients died, an overall mortality of 33.3%. Twenty-seven of 77 patients (35.1%) with

* Traumatology Staff Surgeon, Maryland Institute for Emergency Medical Services.

† (Former) Fellow in Traumatology, Maryland Institute for Emergency Medical Services, (Presently) Attending Surgeon, Franklin Square Hospital, Baltimore, Maryland.

‡ Professor of Cardiovascular and Thoracic Surgery, University of Maryland Medical School, and Director of the Maryland Institute for Emergency Medical Services.

Address correspondence to: Robert W. DuPriest, Jr., M.D., Maryland Institute for Emergency Medical Services, 22 South Greene Street, Baltimore, Maryland 21201.

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TABLE 1. *Initial Injuries and Complications in Patients with Acute Cholecystitis Complicating Trauma*

Patient #	Initial Injuries	Complications
1.	Scalp laceration Bilateral multiple rib fractures Bilateral hemopneumothorax Laceration of ascending colon, spleen, and right lobe of liver Bilateral open femur fracture Open fracture right tibia	Pulmonary infiltrates Sepsis Renal failure Abdominal wound dehiscence UGI bleeding (gastric ulcer)
2.	Multiple right rib fractures Right hemopneumothorax Laceration right lobe of liver	Sepsis Abdominal wound dehiscence Respiratory failure Innominate artery erosion
3.	Closed head injury Open fracture left femur Fractured left humerus and tibia Fracture-dislocation right knee Mesenteric tear	Renal failure Abdominal wound dehiscence Pneumonia Sepsis
4.	Closed head injury Fractured pelvis Fractured left humerus, right femur Bilateral tibia and fibula fractures Ruptured spleen Liver laceration Mesenteric and retroperitoneal hematomas	Sepsis Infected pelvic hematoma
5.	Left femur fracture Ruptured spleen Pelvic hematoma	Recurrent pelvic hemorrhage and wound hematoma
6.	Scalp and face lacerations Mandible fracture C-2/C-3 fracture-dislocation without neurologic deficit Neck and chest wall contusion Liver laceration Pelvic hematoma	UGI bleeding Gastro and colo-cutaneous fistula Multiple intra-abdominal abscesses
7.	Closed head injury T-6 fracture, paraplegia Ruptured spleen Laceration right lobe of liver	Sepsis: pneumonia Cholecysto-cutaneous fistula Cystic artery hemorrhage Hydrocephalus Renal failure
8.	Bilateral wrist fractures Comminuted left femur fracture Ruptured spleen Left renal cortex laceration Retroperitoneal hematoma	Post-splenectomy bleeding Sepsis Subphrenic abscess Duodenal and gastrocutaneous fistula
9.	12 gauge shotgun wound to left chest Lacerated left lower lobe Lacerated brachial artery, vein, and plexus, left Extensive soft tissue damage left axilla	Emergency left thoracotomy Chest wall bleeding Chest wall and arm sepsis Renal, pulmonary, cardiac, and hepatic failure
10.	Right fronto-temporal contusion Left parietal skull fracture Bilateral zygomatic arch fracture Comminuted nasal fracture Mid-facial fracture Facial lacerations	Sepsis Gram negative shock Acute renal failure (oliguric) (required hemodialysis)
11.	GSW to LUQ Lacerated portal vein, common hepatic artery and left lobe of liver Large retroperitoneal hematoma	Persistent hypotension Coagulopathy Autopsy findings: Free intraperitoneal blood
12.	Motorcycle accident Lumbar spine and pelvis fractures Open fractures right tibia and fibula Pelvic and retroperitoneal hematoma Urinary bladder tear Lacerated cecum with massive fecal peritoneal contamination	Renal failure Sepsis Bilateral bronchopneumonia Generalized peritonitis Infected pelvic hematoma Autopsy findings: Generalized peritonitis

TABLE 2. *Pathology, Procedure, and Outcome in Patients with Acute Cholecystitis Complicating Trauma*

Patient #	Age	Sex	Time from admission to diagnosis	Pathology					Procedures		Outcome	
				Stones	No Stones	Necrosis	Gangrene	Perforation	Cholecystectomy	Cholecystostomy	Lived	Died
1	64	M	5 days		+	+			+			+
2	63	M	7		+	+				+		+
3	60	M	25	+		+				+		+
4	47	F	18		+					+	+	
5	44	F	15		+					+	+	
6	48	F	13		+					+		+
7	33	M	36		+		+	(+)*	+			+
8	34	M	11		+		+	+	+		+	
9	67	M	7		+	+			+			+
10	39	M	13		+					+	+	
11	29	M	3†		+		+					+
12	18	M	19†		+							+

* Spontaneous cholecysto-cutaneous fistula preceded gangrenous cholecystitis with hemorrhage. †Autopsy diagnosis.

acalculus cholecystitis died. One of seven (14.3%) patients with calculus cholecystitis died. Thirteen of 15 patients (86.7%) not treated surgically for cholecystitis died. Six of 13 patients (46.2%) treated with cholecystostomy died. Nine of 56 patients undergoing cholecystectomy (16.1%) died.

Discussion

Acute cholecystitis complicating trauma, or following the surgical treatment of unrelated disease, "is more than mere coincidence."[15] This is well documented by Glenn[12,13] and others.[2,9,16,20,22–25,27–30,34,36,38,39,41,42,46,47,49–52,56–58,60] Mortality is high: 40% in Ottinger's series,[41] 75% in our series, and 33.3% in our collected series. The frequently advanced degree of gallbladder pathology when diagnosed contributes to mortality. Necrosis, gangrene, and/or perforation occurs in about 60% of patients.

Gallstones are absent in 22–53% of patients with acute cholecystitis following the surgical treatment of unrelated disease.[15,41,47,56] However, the relative incidence of acalculus cholecystitis is even higher in trauma patients.[23] In two reported series of acute cholecystitis in Vietnam casualties, all patients had acalculus cholecystitis.[28,58] The incidence of acalculus cholecystitis was 91.7% in our patients, and 86.7% in the combined series. Since gallstones are absent

TABLE 3. *Pathology, Therapy, and Mortality in Patients with Acute Cholecystitis Complicating Trauma*

Series	Pathology					Therapy			Deaths					
	Total	Stones	No Stones	Perforation	Gangrene and/or Necrosis	Cholecystectomy	Cholecystostomy	No Operation	Total	Stones	No Stones	Cholecystectomy	Cholecystostomy	No Operation
1. Blatt et al.[4]	1		1		1	1			0					
2. Golden et al.[16]	5	2	3	1	3	4	1		1		1[a]	1		
3. Howard et al.[20]	6	4	2	1	6	6			1		1	1		
4. Inglesakis et al.[22]	3		3	1		2	1		0					
5. Kitchen[24]	1		1		1		1[b]		1		1		1[b]	
6. Lindberg et al.[28]	12		12		7	11	1[c]		2		2	2		
7. Lynch[29]	1		1	1	1			1	1		1			1
8. Mandelbaum et al.[30]	2		2		2	2			0					
9. Meisner[34]	5		5	1	1	3		2	2		2			2
10. Monfort et al.[36]	4		4		4	3	1[d]		0					
11. Munster et al.[38]	10		10	1		2		8	8					8
12. Myers et al.[39]	2		2		2	2			0					
13. Robertson[42]	8	6	2	?	?	?	?		?	?	?	?	?	
14. Schmitt et al.[46]	1		1			1			0					
15. Shaw[49]	8		8	1	5	6		2	0					
16. Shields[50]	1		1		1	1			0					
17. Ternberg et al.[54]	1		1				1		1		1		1	
18. Weeder et al.[58]	6		6		2	4[e]	2		?[e]		?	?	?	
19. Winegarner et al.[60]	9		9	1	4	8	1		3		3	2	1	
20. DuPriest et al.	12	1	11	2[f]	7	4	6	2	8	1	7	3	3	2
Total	98	13	85	10[f]	47	60	15	15	28	1	27	9	6	13
Fraction		13/98	85/98	10/90[g]	47/90[g]	60/90[g]	15/90[g]	15/90[g]	28/84[gh]	1/7[g]	27/77[gh]	9/56[h]	6/13[h]	13/15
Percent		13.3	86.7	11.1	52.2	66.7	16.7	16.7	33.3	14.3	35.1	16.1	46.2	86.7

[a] Late death due to CNS injury; [b]required reoperation & cholecystectomy for hemorrhage from cystic artery; [c]prolonged febrile postop course; [d]required reoperation & cholecystectomy for empyema of gallbladder; [e]three with cholecystectomy survived. Outcome of remaining 3 patients not described; [f]2 patients had both perforation and gangrene; [g]excludes #13; [h]excludes #18.

in most patients with acute cholecystitis complicating trauma, other factors assume etiologic importance. All of our patients had severe initial injury, were in shock on admission, and developed multiple complications.

Local vascular changes in the gallbladder wall associated with shock are considered important by Thompson[56] and Meissner.[34,35] Sympathetic activity during shock may constrict gallbladder vessels. Sympathectomy is protective in experimental canine acute cholecystitis.[19] Vasoactive drugs such as epinephrine, levophed, and dopamine may aggravate vascular changes in the gallbladder.

Simple obstruction of the cystic duct, with saline in the gallbladder, is not sufficient to cause acute cholecystitis.[61] Bile in the gallbladder is required in addition to cystic duct obstruction. The degree of acute cholecystitis is proportional to bile salt concentration,[61] and impaired perfusion enhances the toxic action of bile.[55] Certain factors increase the bile pigment load in trauma patients including massive transfusion,[20,23,41] sepsis, and resorption of sequestered blood from fracture sites and pelvic and retroperitoneal hematomas. Fractures and hematomas were present in eight of our patients. Glenn[12,15] suggests postoperative dehydration increases the viscosity of bile. When the gallbladder contracts after oral feeding the viscid bile may create functional obstruction, precipitating an attack of acute acalculus cholecystitis.

Several other factors may contribute to development of acute cholecystitis complicating trauma. Normal gallbladder motility may be altered by bed rest, fasting,[41] increased intra-abdominal pressure,[23] administration of total parenteral nutrition,[1] and narcotics.[30] Lincomycin is directly toxic to guinea pig gallbladder mucosa.[48] Sepsis is rarely directly implicated in the development of acute cholecystitis following unrelated surgery. However, it has been noted in a number of trauma patients developing cholecystitis.[49,58] Two of our patients had sepsis antecedent to acute cholecystitis. However, in most patients it is probable, as Ternberg[54] states, that bacterial invasion is not the initial etiologic factor in acute cholecystitis, but is a complication superimposed on an already diseased or injured organ.

Many reports emphasize the absence of direct injury to the gallbladder or the abdomen in patients with acute cholecystitis complicating trauma.[4,16,20,24,30,49,50,60] None of Howard and Delaney's patients had abdominal trauma.[20] However, ten of our patients had serious abdominal injuries and six had liver lacerations. Although direct trauma to the gallbladder was not externally discernable in any of our patients, occult trauma, intracholecystic hemorrhage, or damage to the blood supply of the gallbladder could not be ruled out. Trauma during surgery may also be implicated.

Acute cholecystitis is easily recognized in most patients.[57] However, the presence of acute cholecystitis complicating trauma is much less obvious. We missed the diagnosis initially in ten patients. Lack of clinical and biochemical specificity in the presentation[22] contributes to delay in diagnosis and treatment.

Available diagnostic radiographic procedures are of limited value. Oral cholecystogram is not suitable in most trauma patients. Intravenous cholangiography has significant diagnostic limitations, as well as risk.[8,37,41] Infusion tomography using total body opacification[40] is highly accurate in acute cholecystitis but may be negative in gangrenous cholecystitis.[7]

Ultrasound is useful to evaluate the liver, gallbladder, and the biliary tree.[3,16,17,18,21,53] In acalculus cholecystitis it may show an enlarged gallbladder without internal echos, and also the absence of contraction after a fatty meal.[18] We employed sonography in four patients. Two had an enlarged gallbladder suggestive, in retrospect, of acalculus cholecystitis. A third patient had a perforated and collapsed gallbladder which obviously could not be identified by sonography. The abdominal incision, sutures, and dressings may have contributed to a nondiagnostic study in the fourth patient.

Hepatobiliary scanning is a relatively new technique useful for evaluating jaundice.[43–45,59] It can demonstrate cystic duct obstruction.[10,31,43]

As Ottinger[41] noted in discussing diagnosis of acute cholecystitis in the postoperative patient, the diagnosis of acute cholecystitis complicating trauma rests primarily on the clinical situation and the findings of physical examination. Clinical suspicion of intra-abdominal sepsis was the most helpful parameter to us in deciding to perform laparotomy, and laparotomy appeared to be the most accurate method of establishing the diagnosis. As noted by Glenn and McSherry,[14] "the penalty for misdiagnosis for a patient subjected to operation who proves not to have cholecystitis is much less than the penalty for failure to recognize an acutely inflammed and infected gallbladder that later perforates."

The high incidence of necrosis, gangrene, and perforation in acute cholecystitis complicating trauma dictates the need for immediate surgical intervention. The choice of operation depends on local anatomy, pathology, and the general condition of the patient. However, when there are patches of necrosis or gangrene, insertion of a cholecystostomy tube[11,13] may not halt the pathologic process. The gallbladder may

develop further ischemia progressing to total gangrene. Kitchen's[24] patient developed complete gangrene of the gallbladder and lifethreatening hemorrhage from the cystic artery after undergoing cholecystostomy. Patient 7 in this report had a similar course following spontaneous external decompression of the gallbladder due to fistula formation. Whenever possible, cholecystectomy appears to be the optimum procedure for treatment of acute cholecystitis complicating trauma.

In view of the multifactorial etiology, prevention of this complication appears to be difficult. Restoring perfusion and maintaining adequate hydration are important. If there is any evidence of trauma to the gallbladder, cholecystectomy should be performed. Simple hepatic arterial ligation in the absence of trauma, or arterial obstruction following selective hepatic arteriography, has not led to acute cholecystitis. However, if hepatic trauma is such that ligation of the right or common hepatic artery is necessary, cholecystectomy should be considered.[33]

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